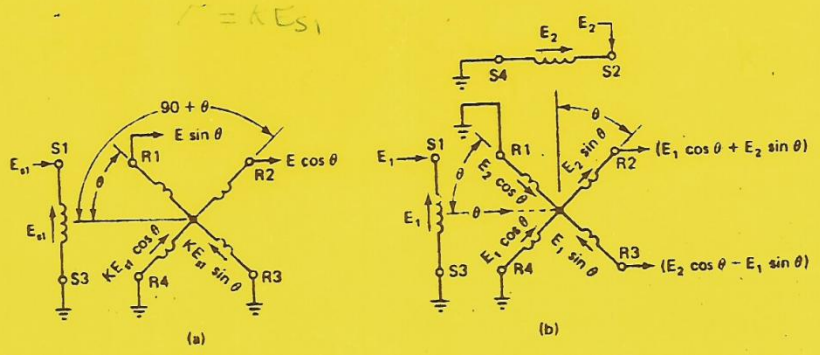
(1)

RESOLVERS

Resolver is a form of SYNCHRO having a rotor with two qudrature phases. It is used in radar and for computing. Resolvers generate e.m.f.s in their rotor winding proportional to the angle of the rotor.

Problems such as rotation of coordinates, solution of triangles for angles and sides, addition of angles, transformation between rectangular and polar coordinates, the resolution composition of vectors can be solved with electrical resolvers.

In Fig. 1(a), a rotor has two independent, perpendicular windings, R1-R3 and R2-R4. The windings are not split coils but are sectionalized in the drawing for clarity.



S1-S3 is a stator winding. A displacement angle θ, is defined as the angle between the R_1-R_3 widg axis and the perpendicular to the S1-S3 winding. The R_2-R_4 axis is at $90+\theta$ with respect to S1-S3.

When $\theta = 0$, with voltage E_{S1} applied to the stator, no voltage is induced in R_1-R_3

When $\theta = 90^\circ$, the voltage induced in R_1-R_3 is KE_{S1}, where K is the rotor-to-stator turns ratio.

At any other angle, voltage induced in R_1-R_3 winding is $KE_{S1}\sin\theta$. Concurrently, the voltage induced in R_2-R_4 is $KE_{S1}\sin(90+\theta)$ $= KE_{S1}\cos\theta$.

if $K = 1$, $E_S = E$.

$\therefore$ $E_{R_1} = E\sin\theta$

$E_{R_2} = E\cos\theta$

This is a polar-Rectangular coordinate-conversion system.

If a second stator winding, S2-S4 perpendicular to S1-S3, is added (Fig. 16).

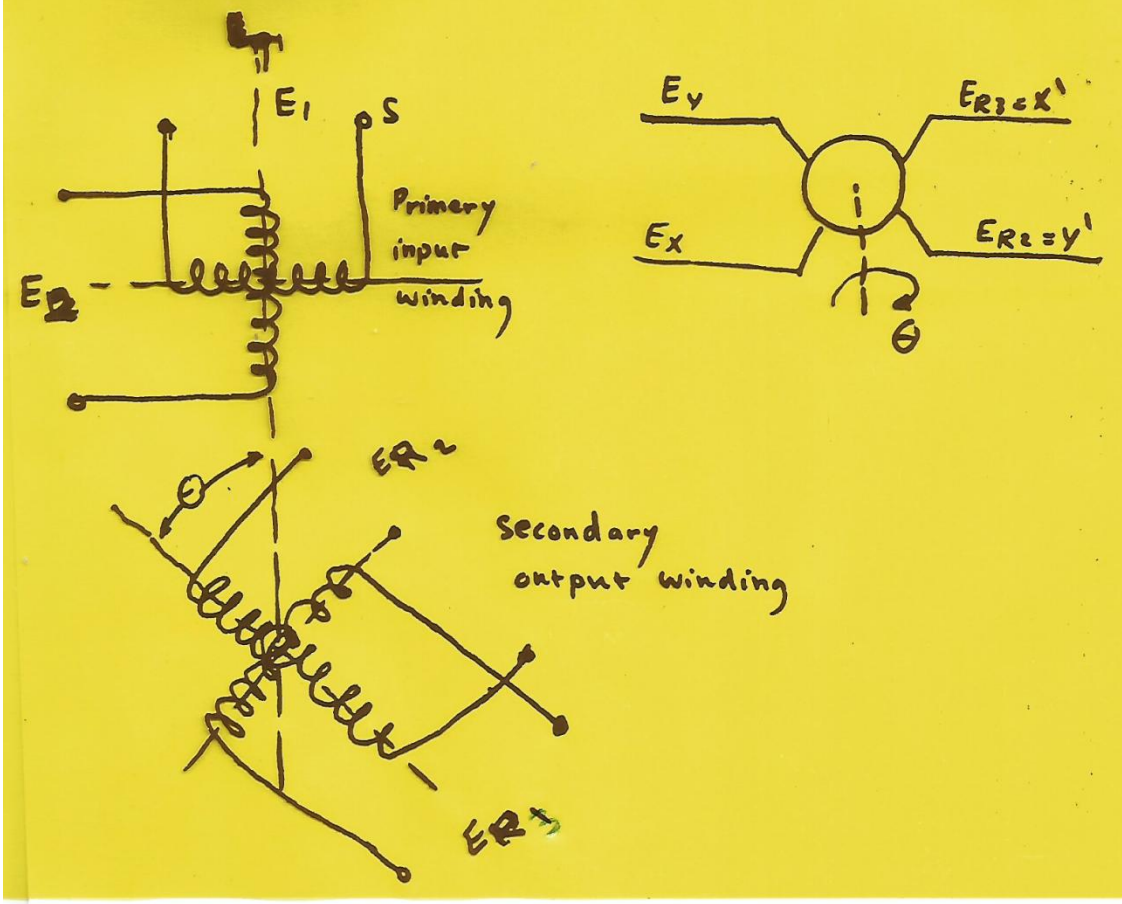
then each rotor winding has two induced voltage components that add arithmetically if E_1 and E_2 are in phase.

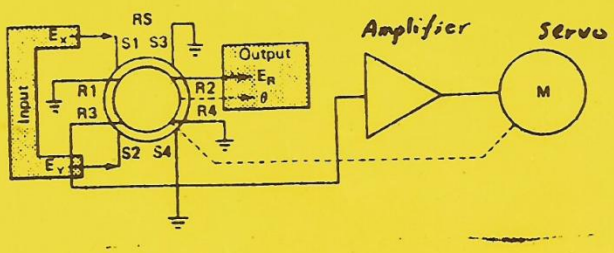
With R_1 and R_4 grounded, the potential at R_2 is

$$E_{R_2} = k(E_1 \cos\theta + E_2 \sin\theta)$$

and at R_3 is

$$E_{R_3} = k(E_2 \cos\theta - E_1 \sin\theta).$$





$$E_R = \sqrt{E_x^2 + E_y^2}$$

Fig. above shows one use of resolver solving the problem to transfer from rectangular to polar coordinates.

E_x and E_y are voltages whose magnitudes represent the x and y coordinates, respectively. The rotor arrangements are the same in Fig. 16 therefore, the output at R3 is $E_y \cos\theta - E_x \sin\theta$. This voltage is amplified and applied to a motor that rotates the resolver to the null position where the output at R3 is 0. At this position,

$$E_y \cos\theta = E_x \sin\theta$$

$$\frac{E_y}{E_x} = \frac{\sin\theta}{\cos\theta} = \tan\theta \quad \text{and} \quad \theta = \tan^{-1}\frac{E_y}{E_x}$$

Therefore, the mechanical orientation of the rotor is at the angle of the corresponding polar Coordinate.